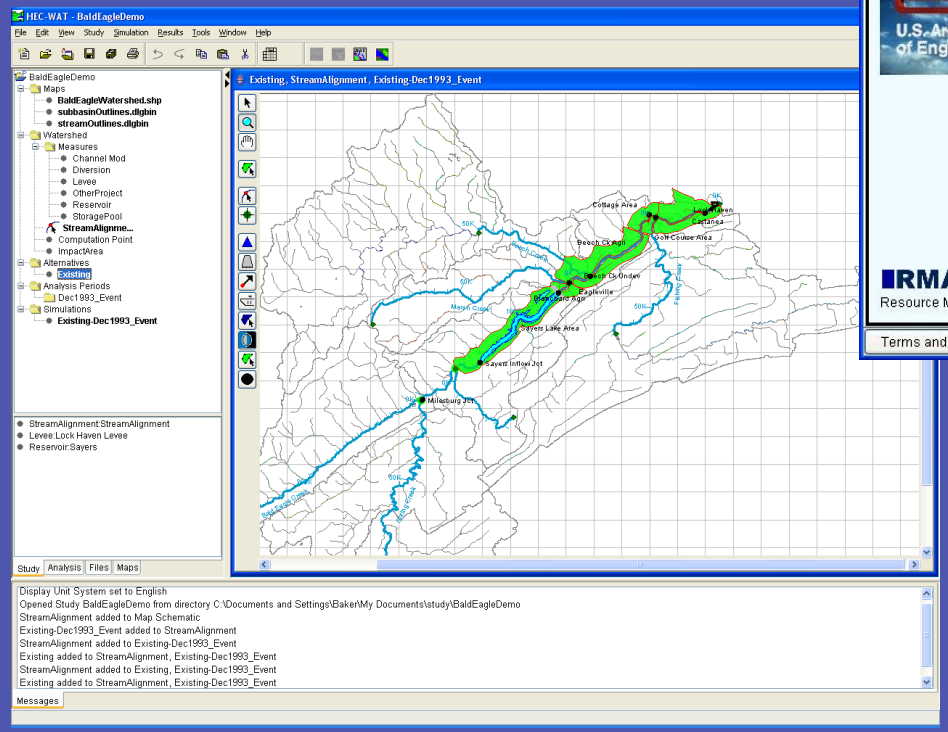
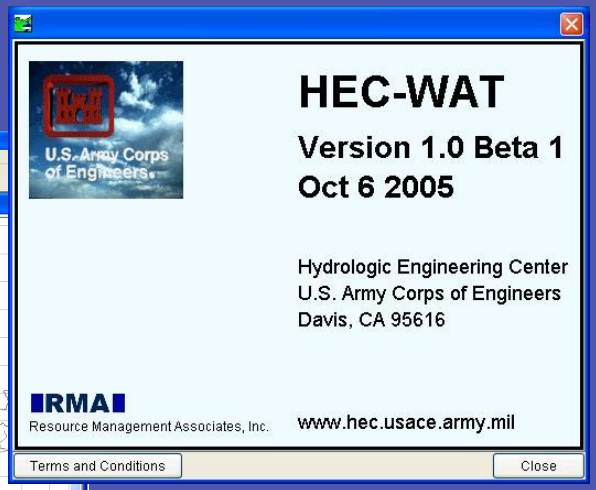
Watershed Analysis Tool

HEC-WAT Program





Chris Dunn, P.E., USACE Hydrologic Engineering Center May 2006

Watershed Analysis Tool (HEC-WAT)

- Corps watershed and water resources management studies identify problems and opportunities and perform alternative analyses to address them.
- Studies require hydrologic, hydraulic, economic, environmental, and social impact assessments.
- Need to develop an interface that will streamline and integrate the analytical process using the tools commonly applied by the multi-disciplinary teams of Corps offices.
- The goal of HEC-WAT is to help offices perform watershed and/or system-wide studies.

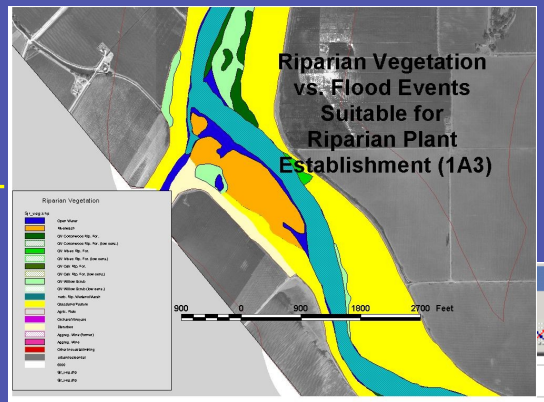
Watershed Analysis Tool (HEC-WAT)

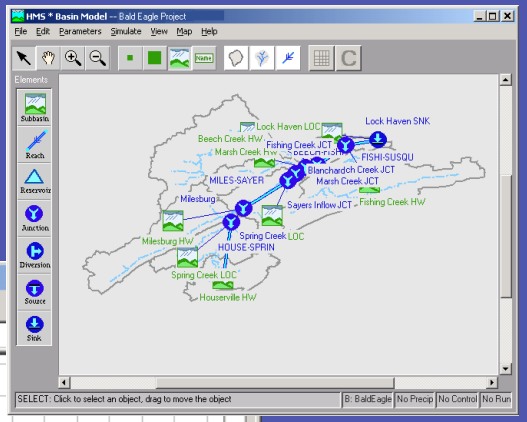
- Coordinate and organize components of a water resources study
- Provide a central organized repository of data / models / results
- Designed to be used for multi-group and multi-agency as well as a single entity
- Improve coordination and communication across the study team
- Involve modelers early in the study process

HEC-WAT Model Integration

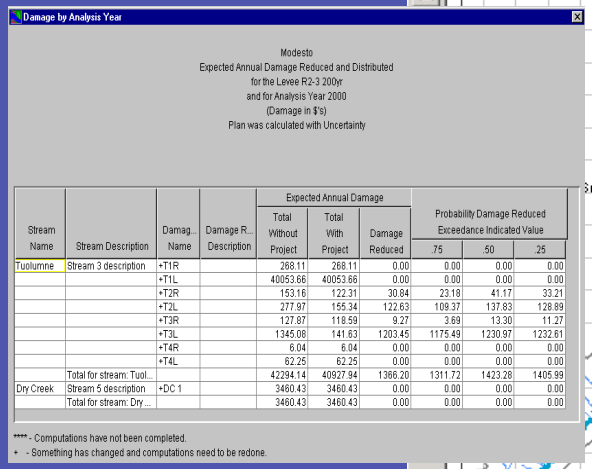
- Integrate model and tools used during the analytical process
  - *Hydrology - HEC-HMS, GeoHMS*
  - *Reservoir Operations - HEC-ResSim, RiverWare in a future release*
  - *Hydraulics - HEC-RAS, GeoRAS*
  - *Economics - HEC-FIA and HEC-FDA*
  - *Environmental - HEC-EFM*
  - *Statistical – HEC-SSP (in development)*
  - *Other software*

Environmental


Riparian Vegetation vs. Flood Events Suitable for Riparian Plant Establishment (1A3)
Riparian Vegetation
900 0 900 1800 2700 Feet



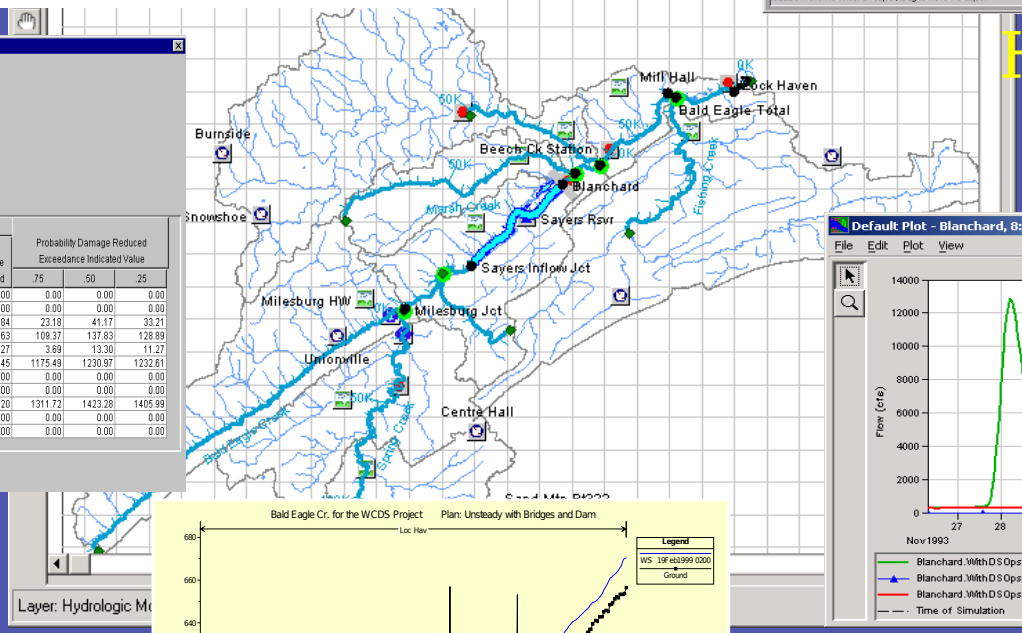
Hydrology

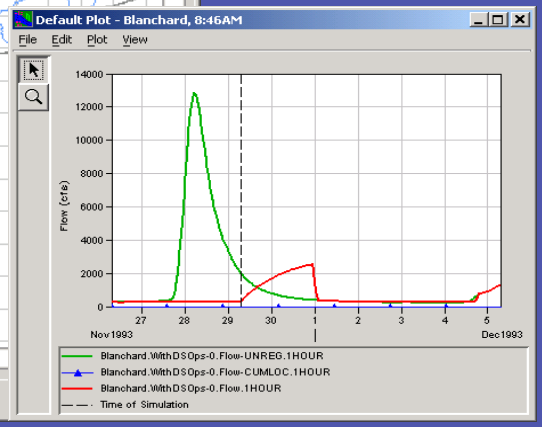

Damage by Analysis Year
Modesto
Expected Annual Damage Reduced and Distributed
for the Levee R2-3 200yr
and for Analysis Year 2000
(Damage in $'s)
Plan was calculated with Uncertainty

Stream Name	Stream Description	Damag... Name	Damage R... Description	Expected Annual Damage			Probability Damage Reduced Exceedance Indicated Value		
				Total Without Project	Total With Project	Damage Reduced	.75	.50	.25
Tuolumne	Stream 3 description	+T1R		268.11	268.11	0.00	0.00	0.00	0.00
		+T1L		40053.66	40053.66	0.00	0.00	0.00	0.00
		+T2R		153.16	122.31	30.84	23.18	41.17	33.21
		+T2L		277.97	155.34	122.63	109.37	137.83	128.89
		+T3R		127.87	118.59	9.27	3.69	13.30	11.27
		+T3L		1345.08	141.63	1203.45	1175.49	1230.97	1232.61
		+T4R		6.04	6.04	0.00	0.00	0.00	0.00
		+T4L		62.25	62.25	0.00	0.00	0.00	0.00
	Total for stream: Tuol...			42294.14	40927.94	1366.20	1311.72	1423.28	1405.99
Dry Creek	Stream 5 description	+DC 1		3460.43	3460.43	0.00	0.00	0.00	0.00
	Total for stream: Dry ...			3460.43	3460.43	0.00	0.00	0.00	0.00

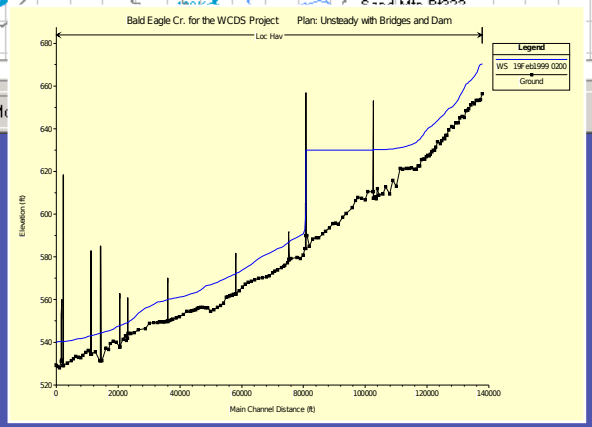
**** - Computations have not been completed.
+ - Something has changed and computations need to be redone.

Flood Damage





Reservoir



Hydraulics

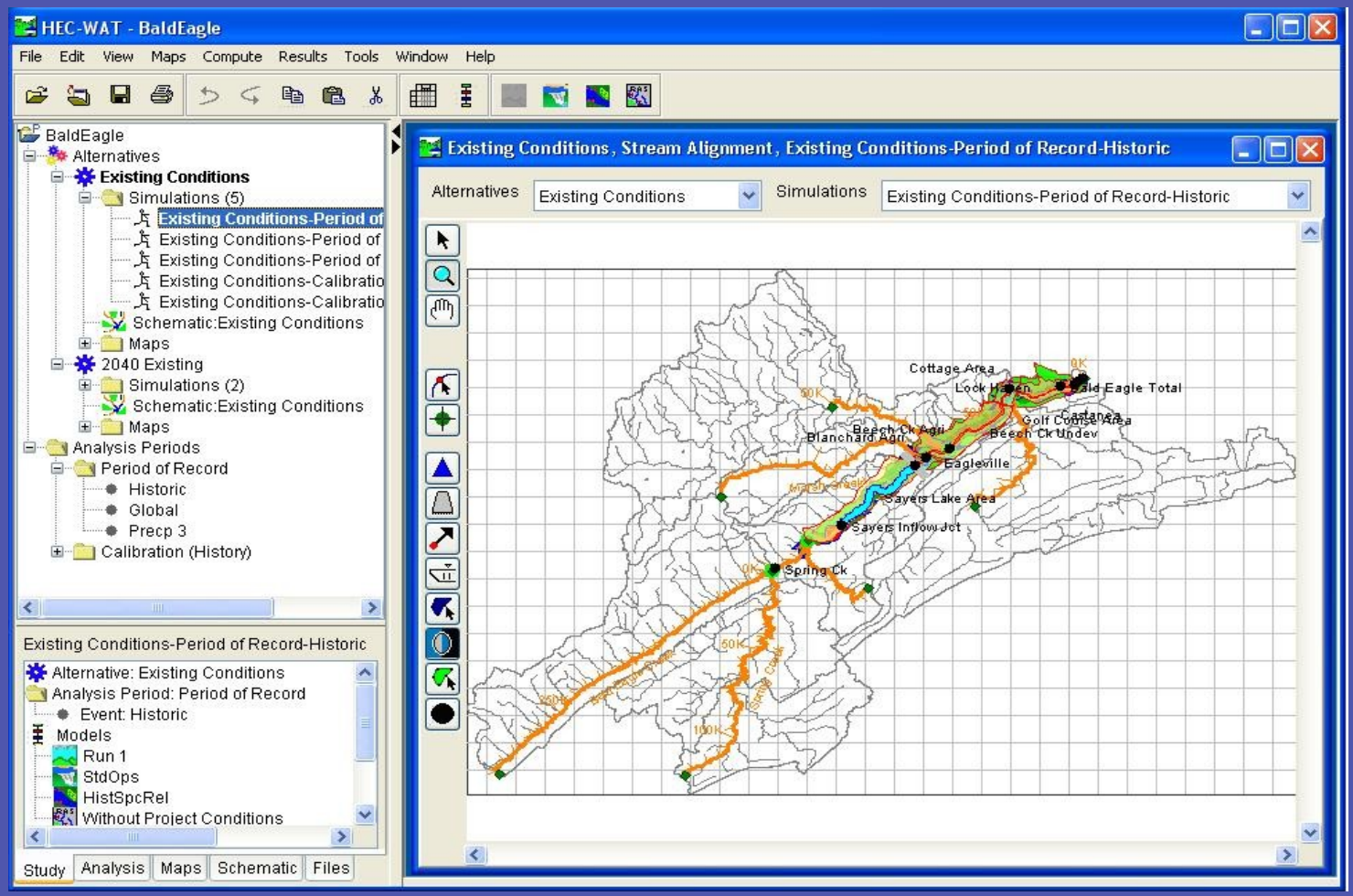
HEC-WAT Model Integration

- Models incorporated into WAT using a “plug-in” concept
  - Tightly integrated – more work and more access to model components
    - Access model parameters directly
    - View results in the model
  - Loosely integrated – less work, but less access to the model
    - Change model parameters outside of WAT
    - View results in ad-hoc plots and tables
- Based on CWMS, Corps Water Management System
  - Real-time use for water control decision support

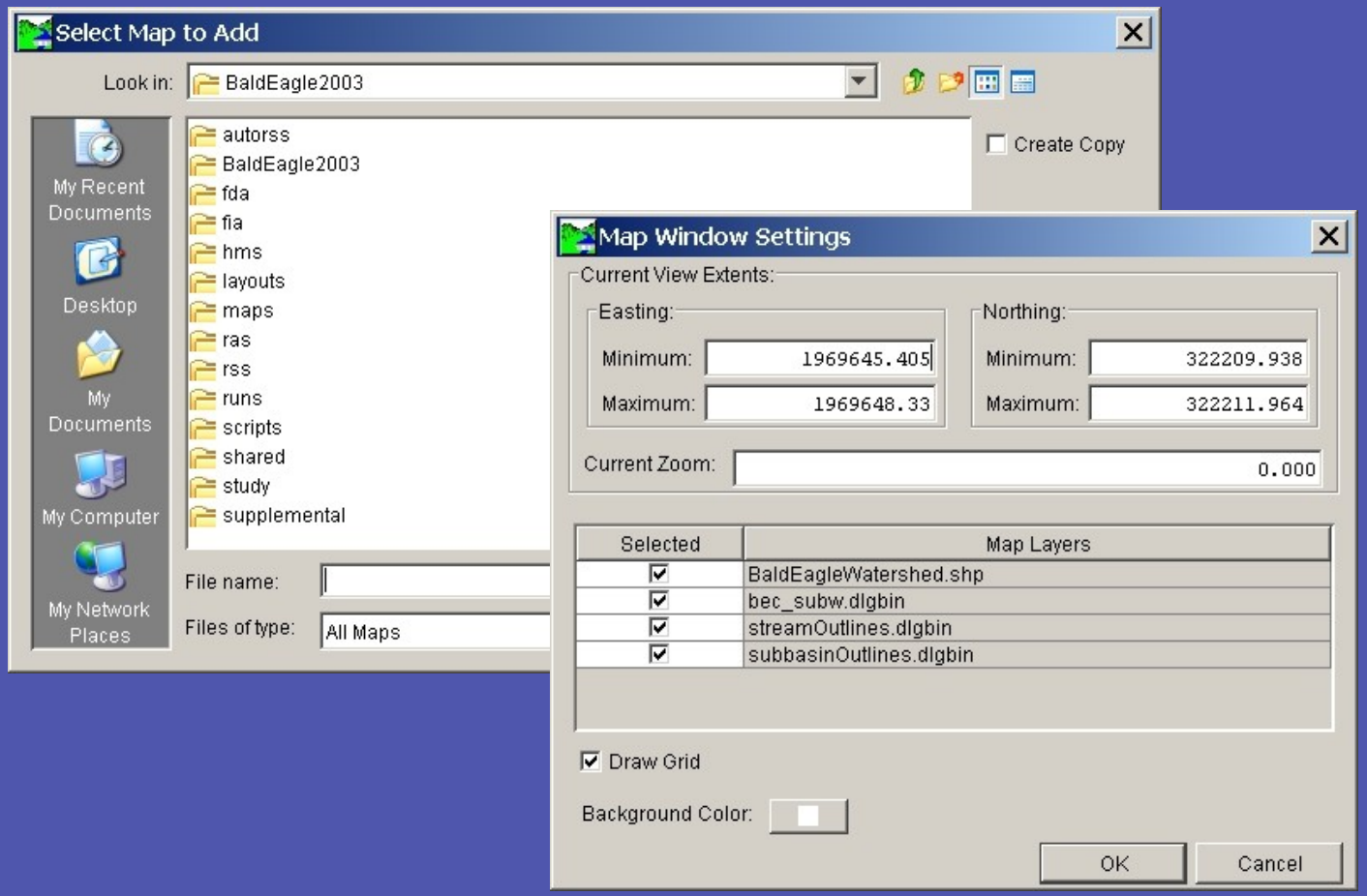
HEC-WAT Framework

- HEC-WAT provides a common, central framework for studies
  - Load GIS based files, such as shape files, DEMs, etc.
  - Establish a stream network and configuration
  - Define common computation points, which are locations shared by more than one model
  - Define modeling programs and their sequence order
  - Import existing models or develop models from WAT
  - Consistent naming of locations across models

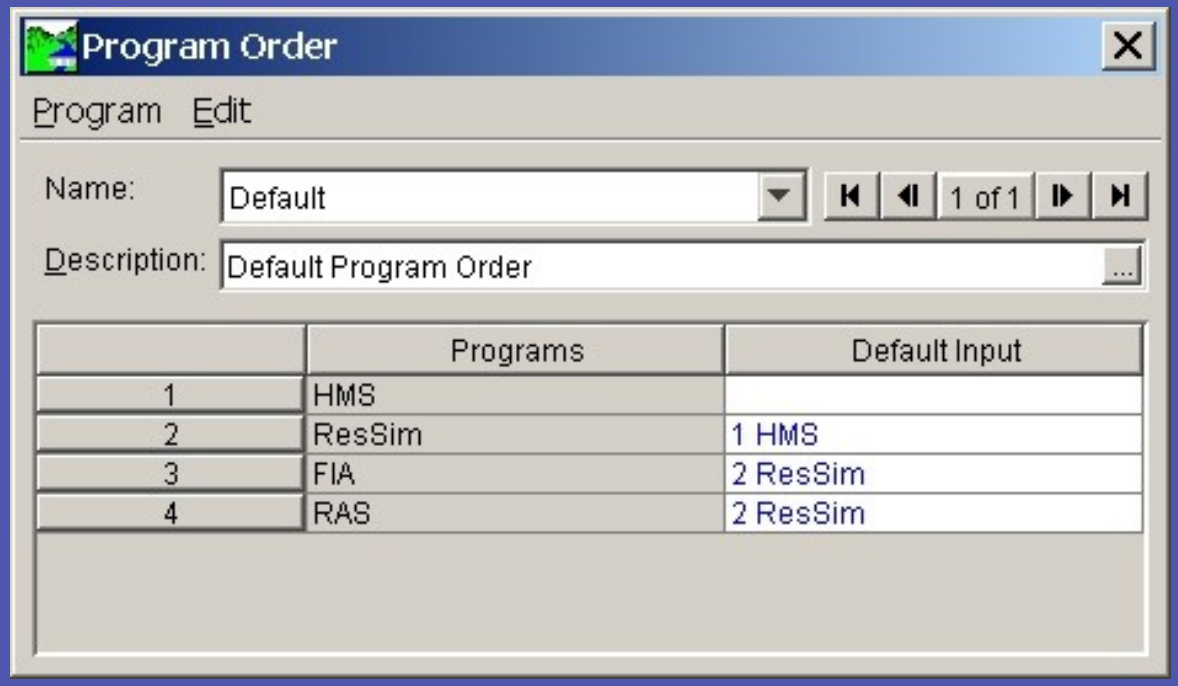
WAT Main Screen



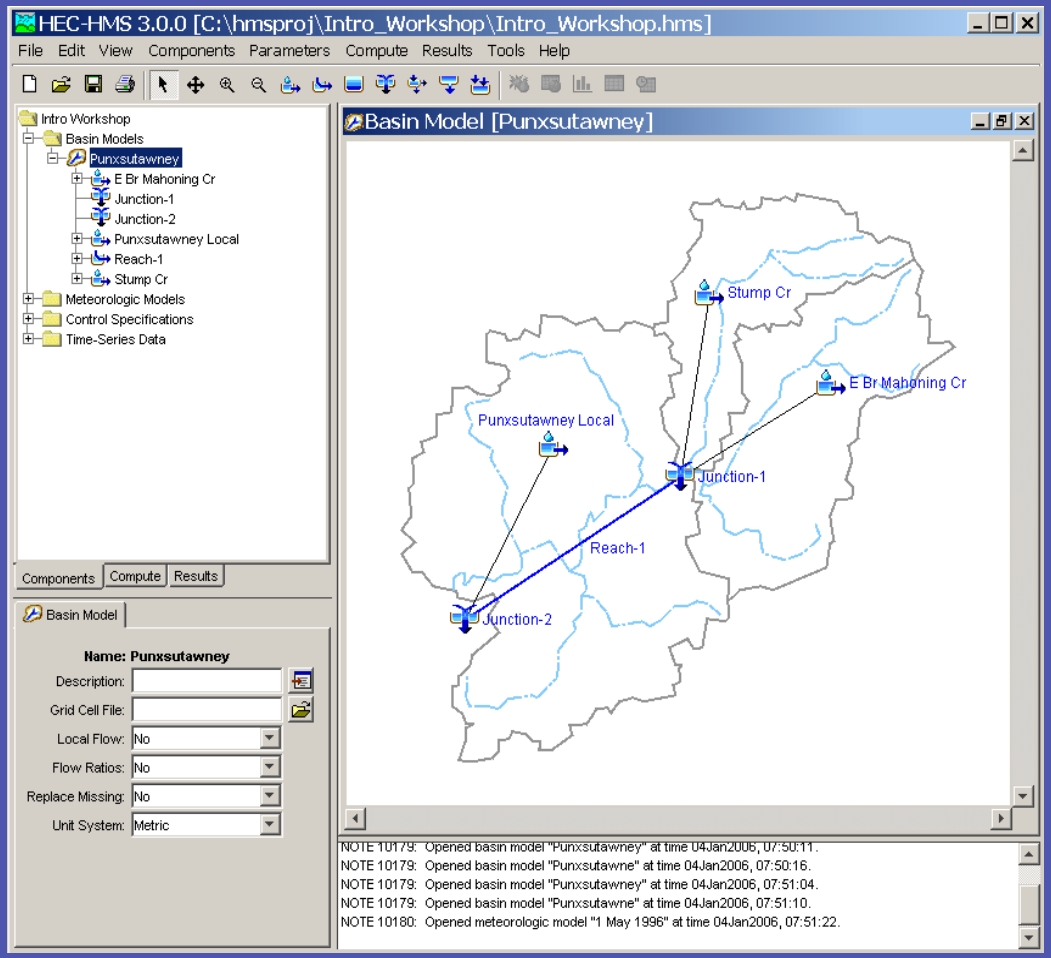
Import Map and Backgrounds



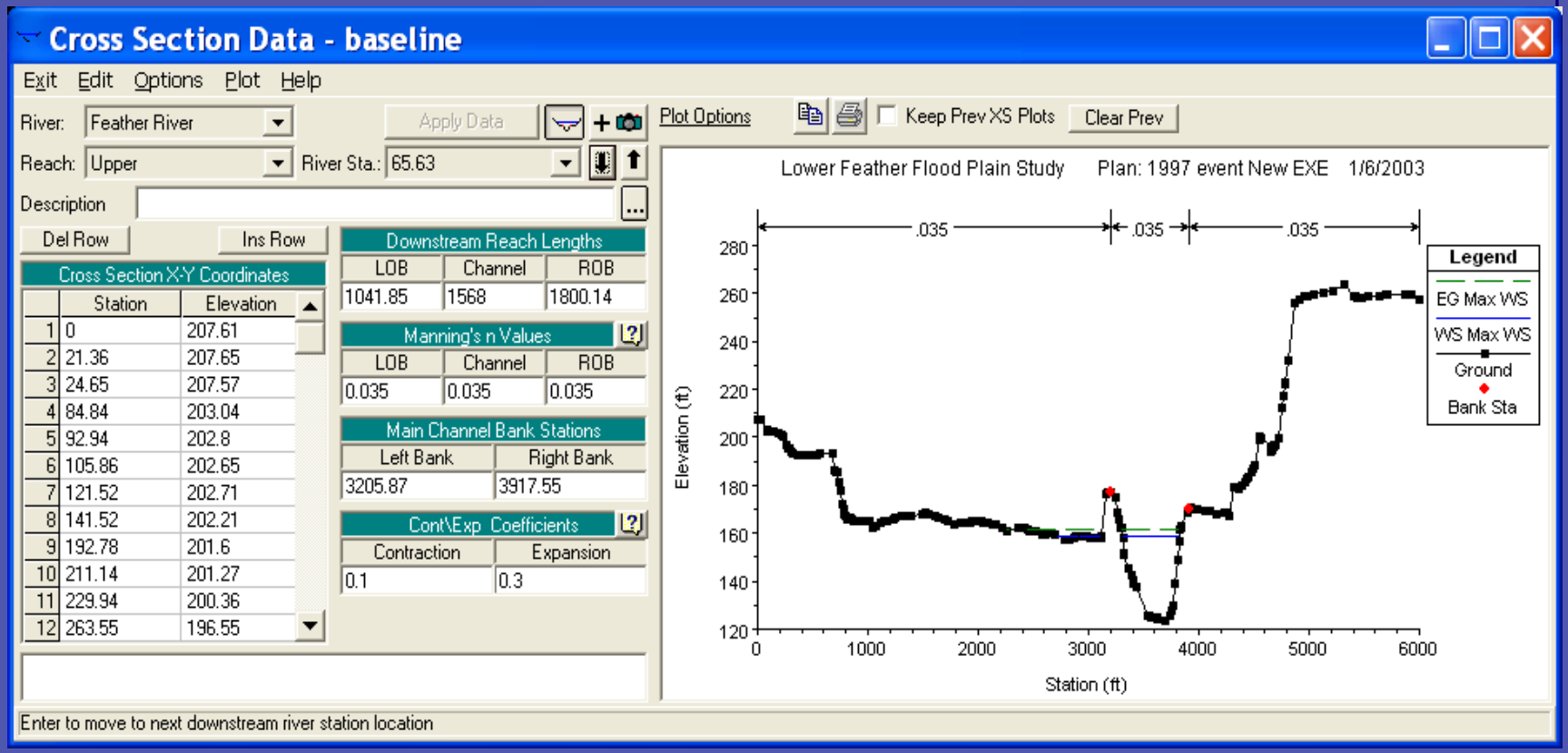
Define Modeling Programs and Sequence



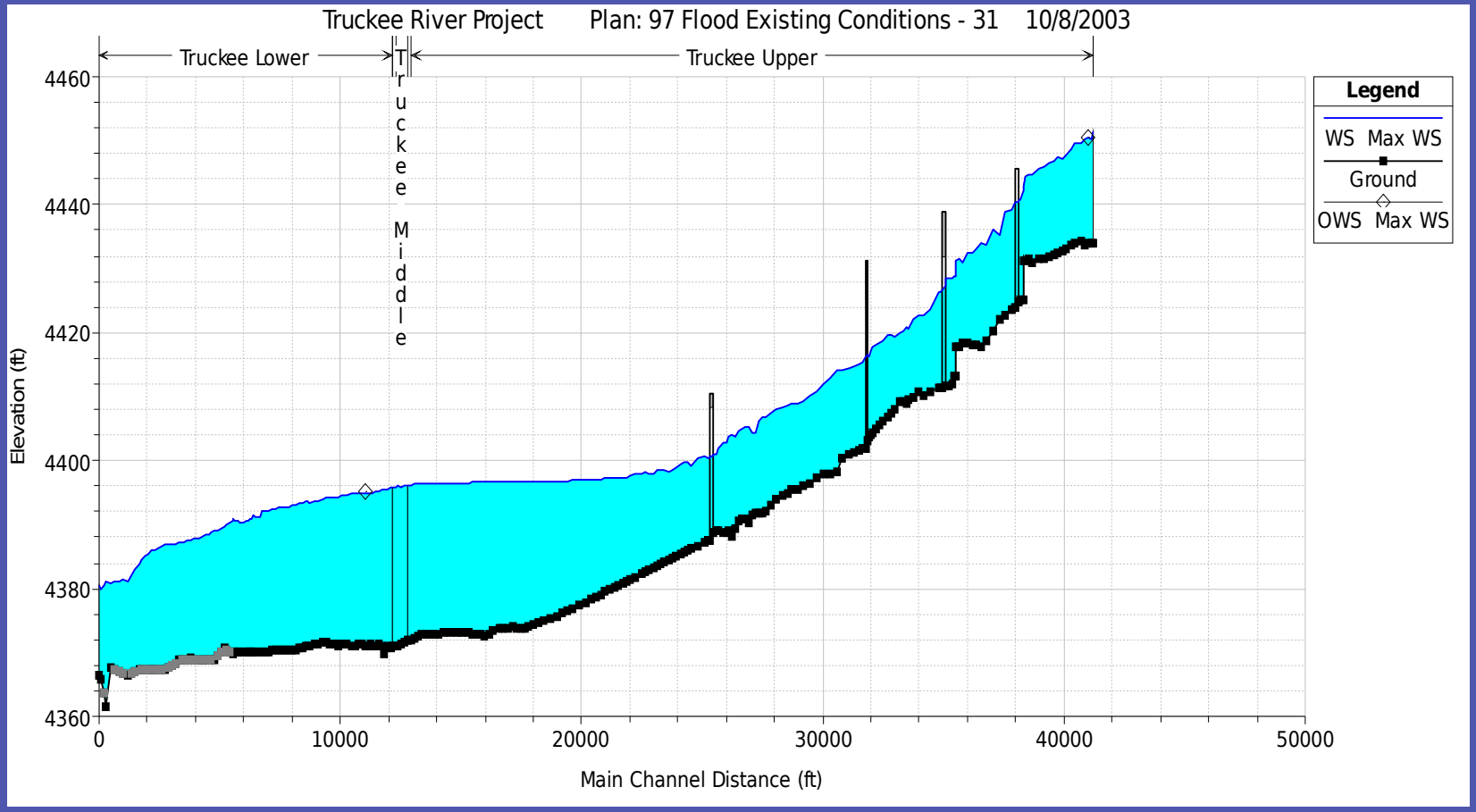
Work with Models Directly from WAT (HMS)



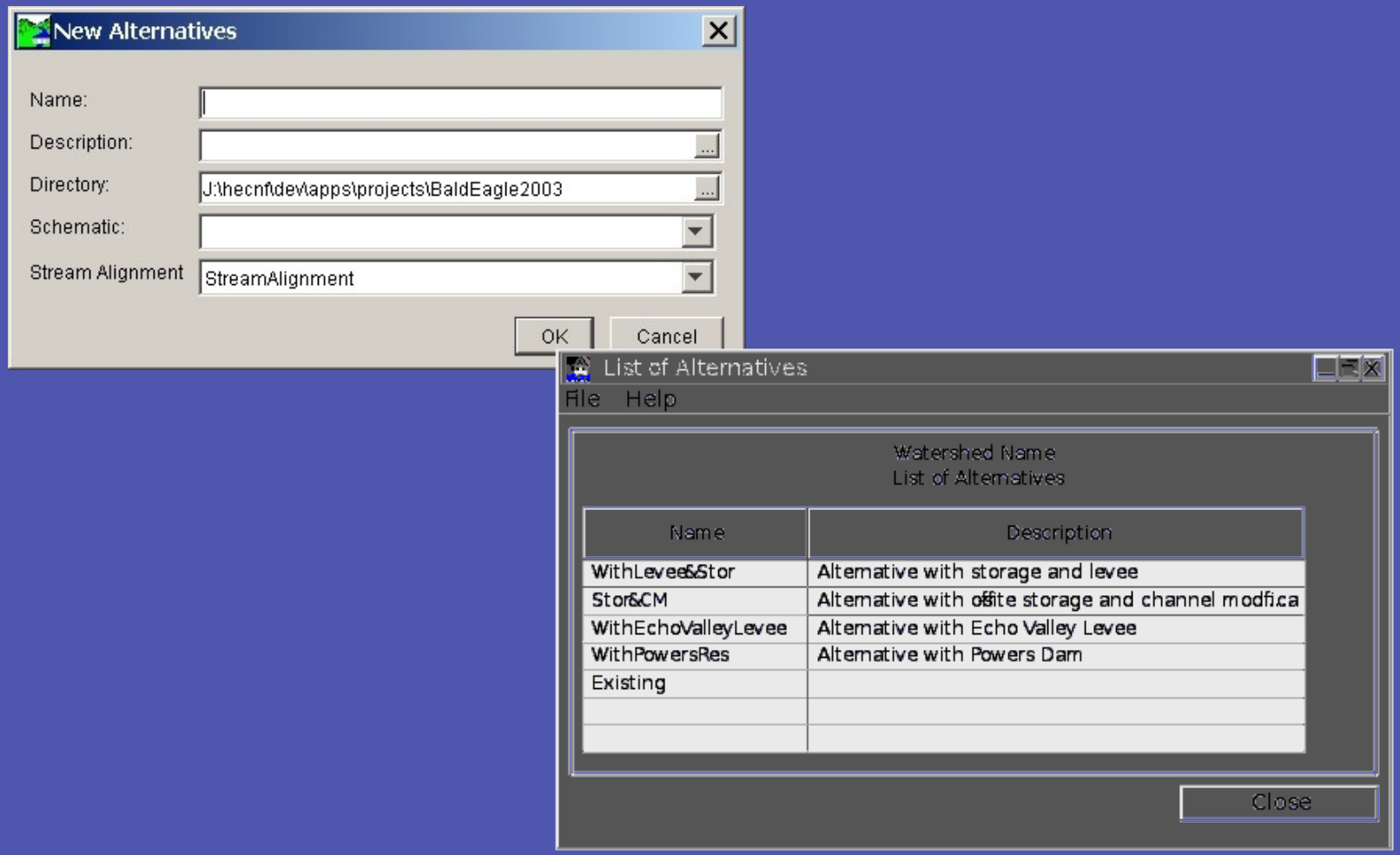
Work with Models Directly from WAT (RAS)



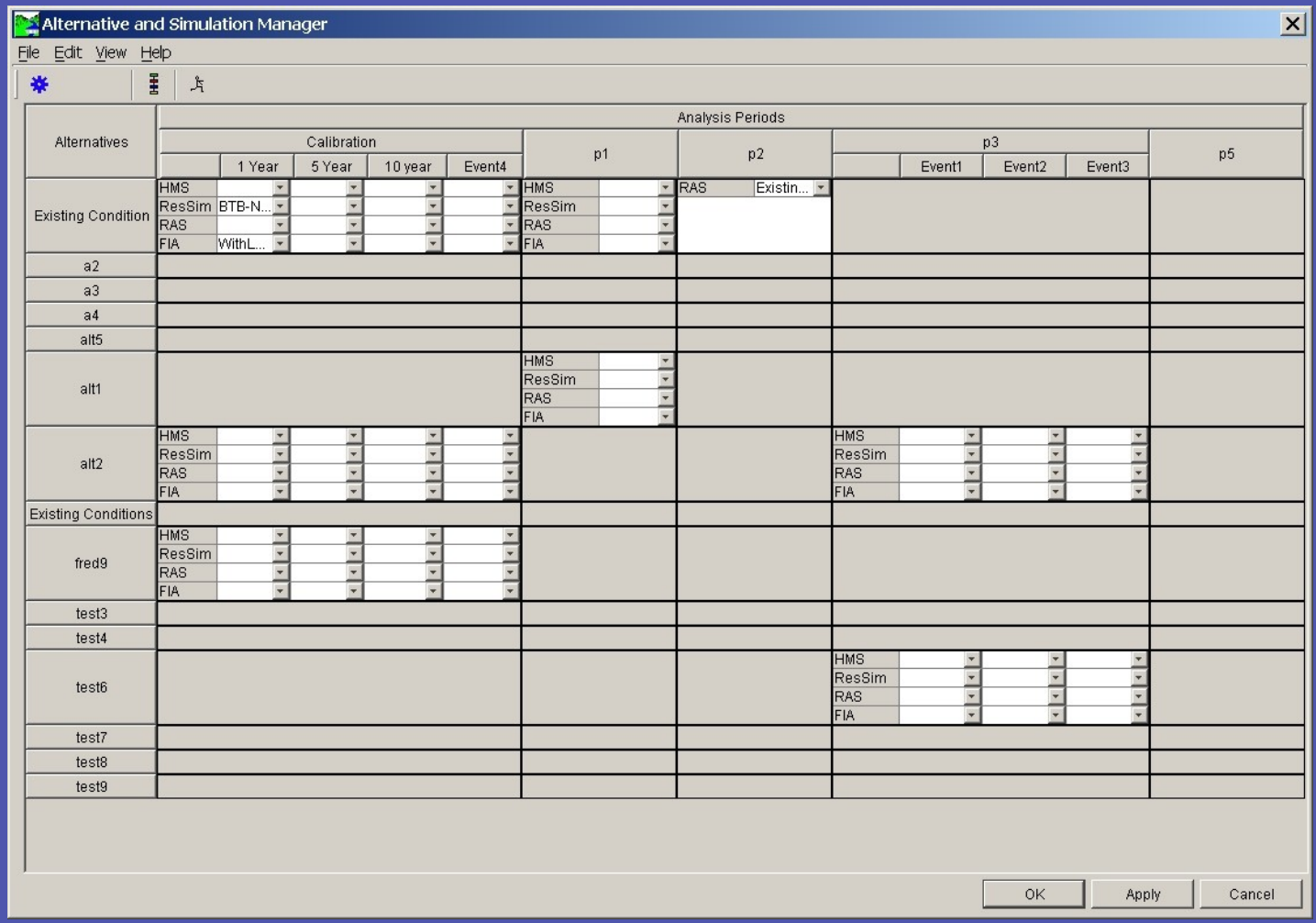
Evaluate Model Results from WAT (RAS)



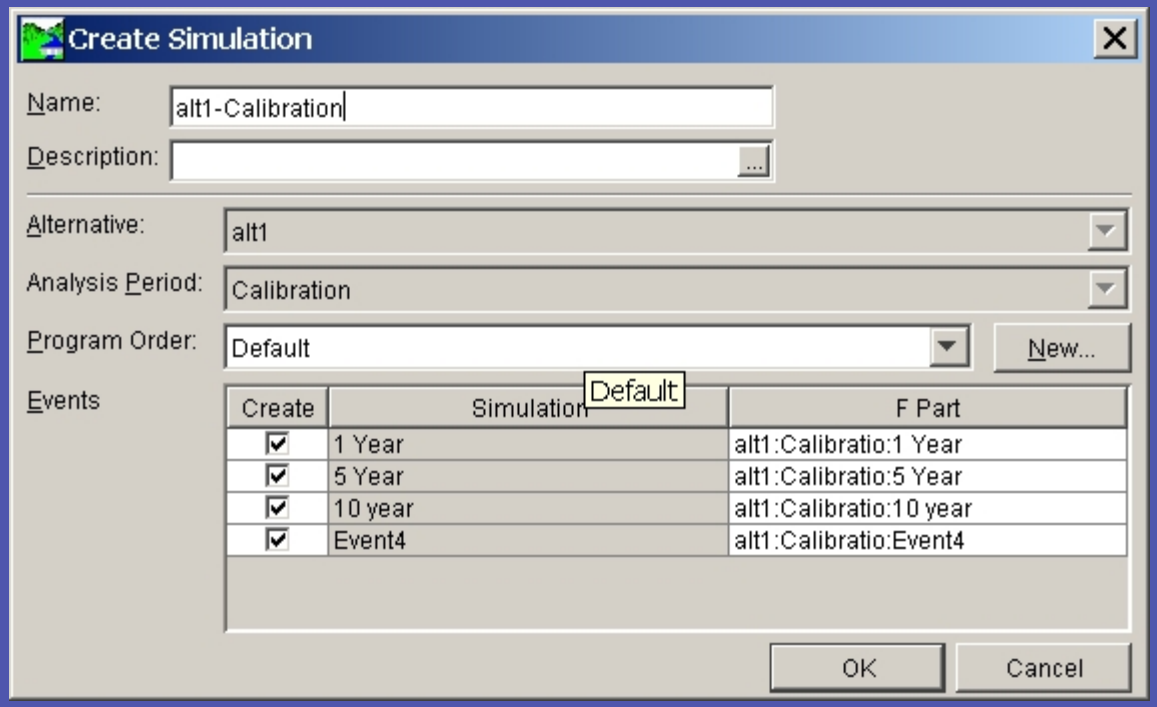
Create “Alternatives” (conditions)



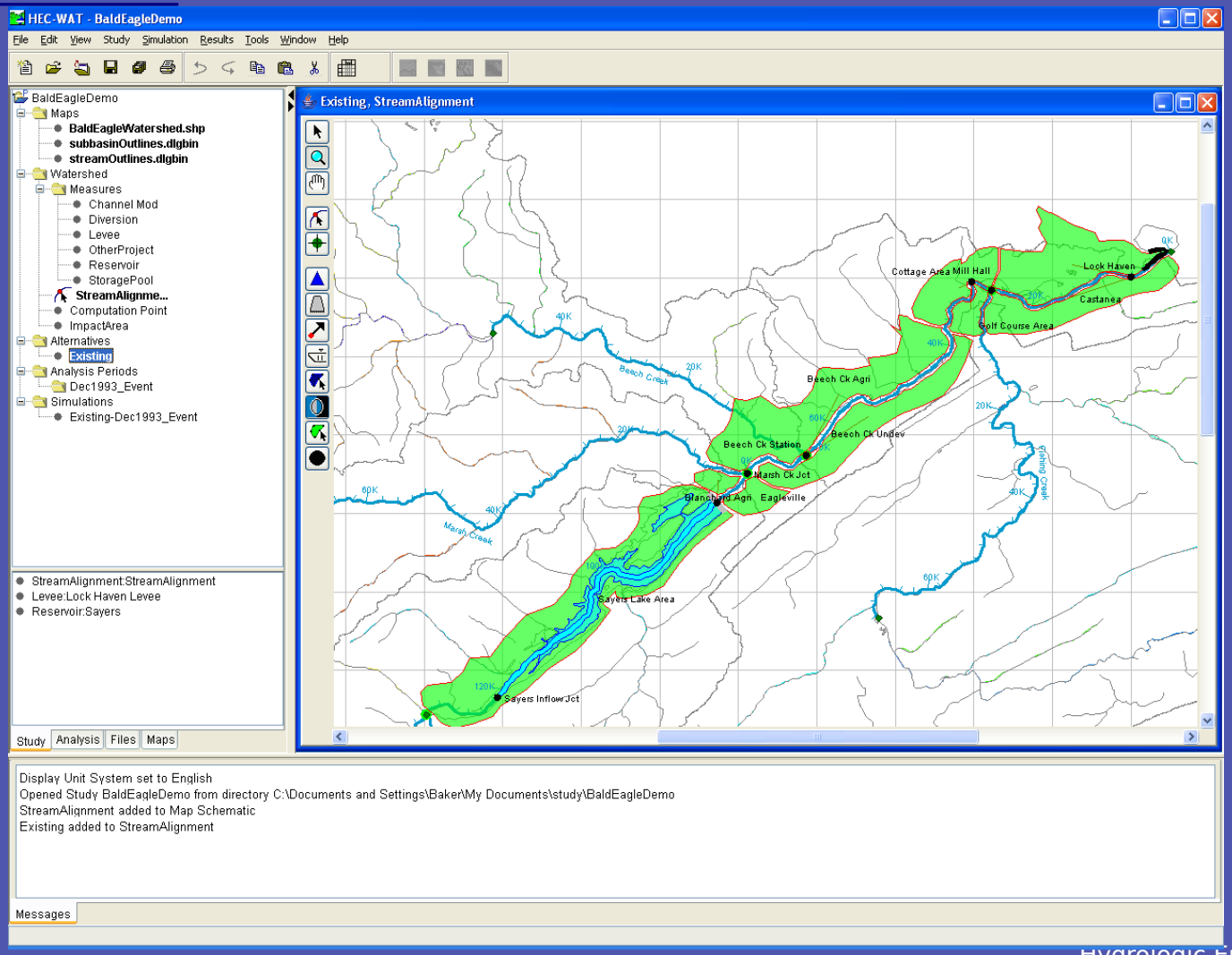
Alternative and Simulation Manager



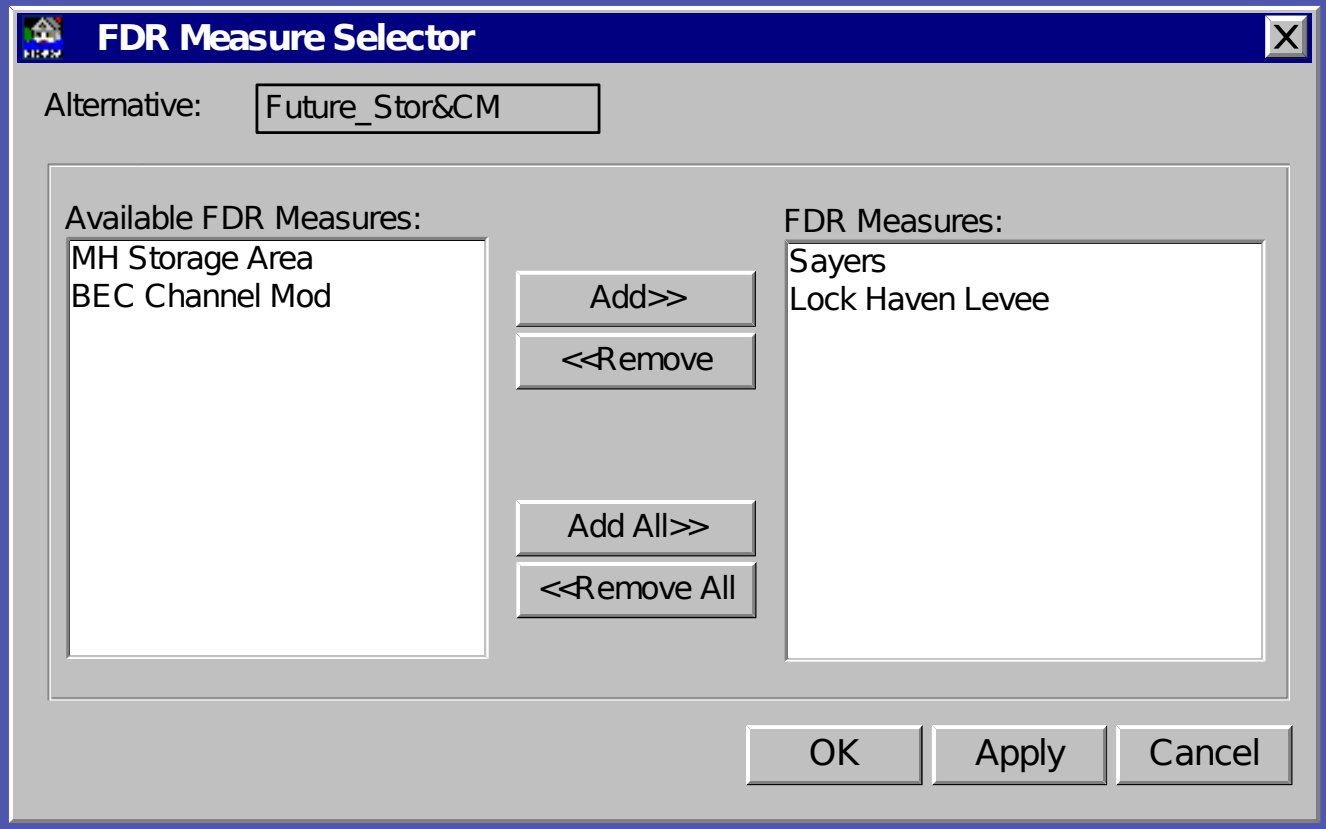
Running Simulations



Existing Alternative

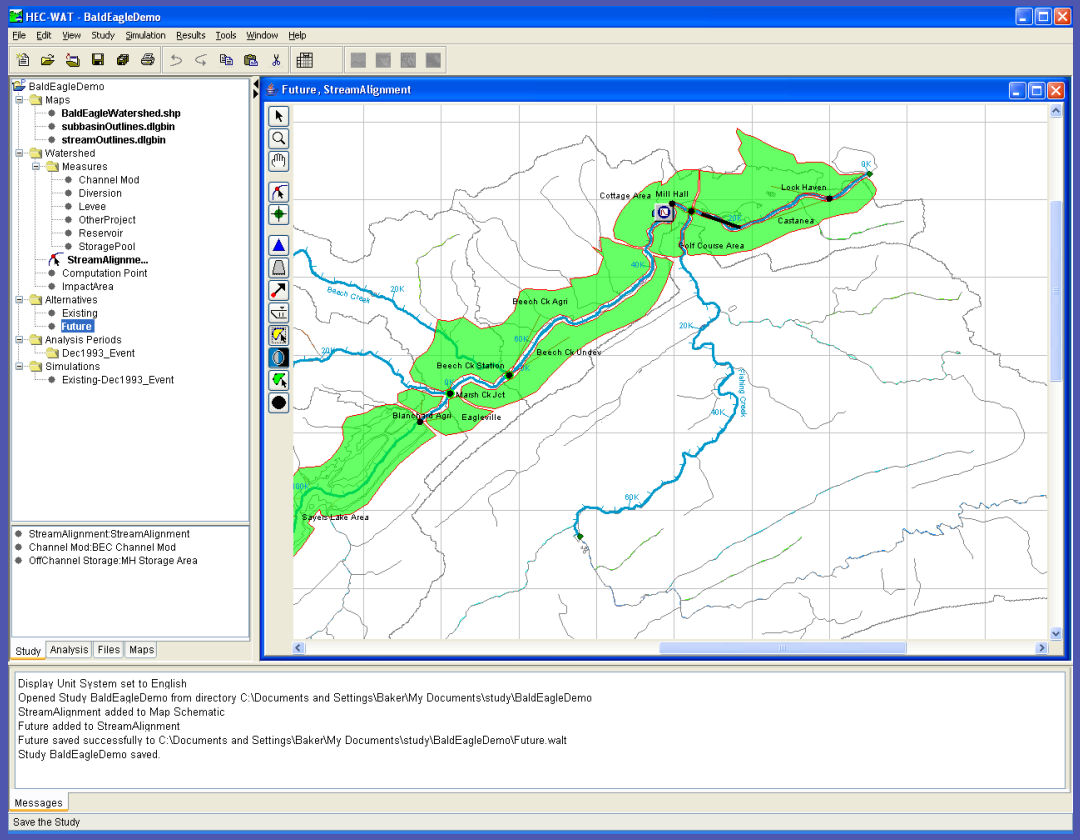


Flood Reduction Measure Selector

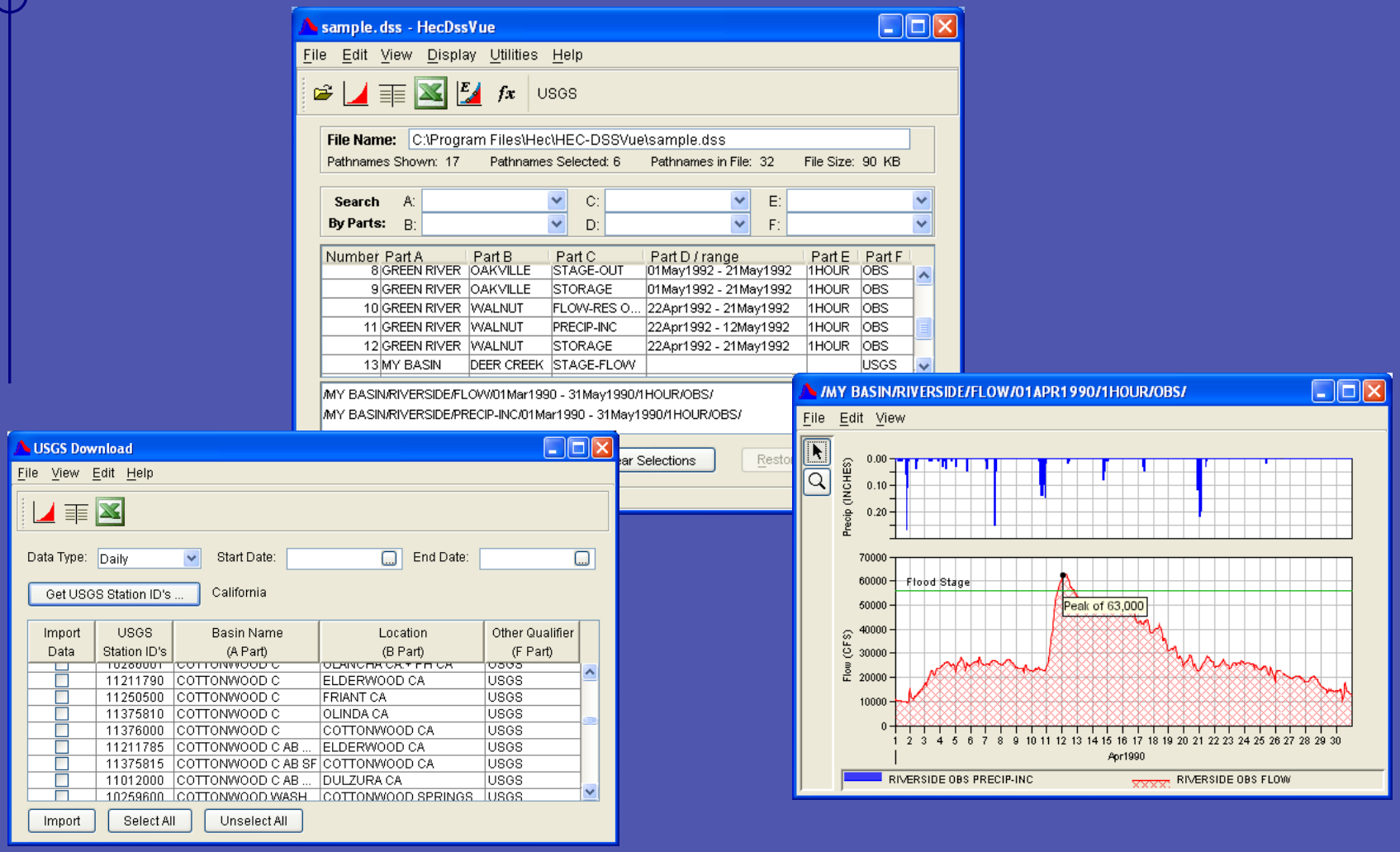


Future Alternative

With Storage and Channel Modification

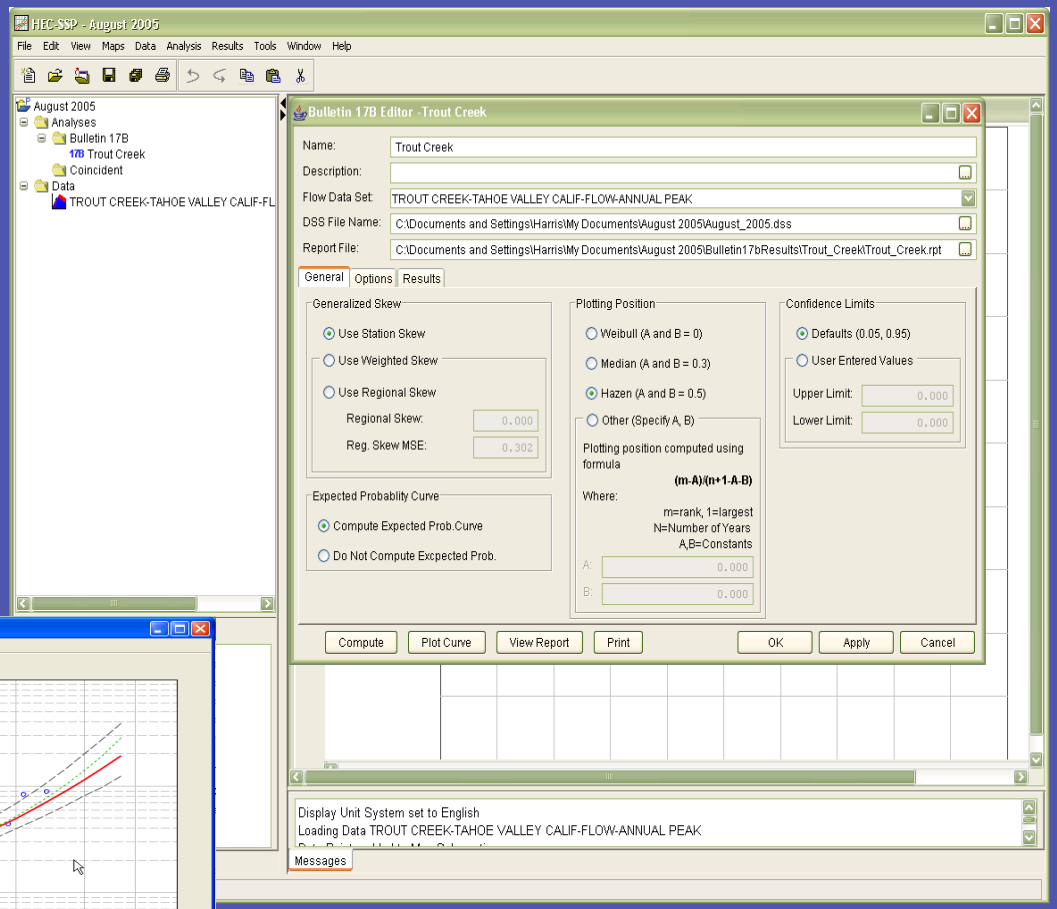


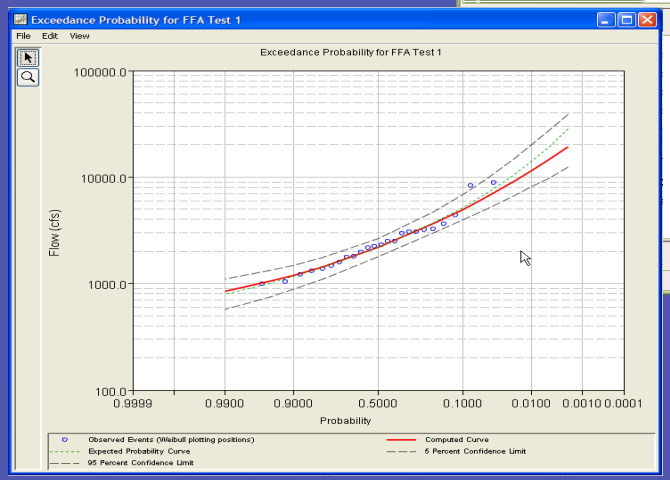
Data Acquisition and Exchange with HEC-DSS


sample.dss - HecDssVue
File Edit View Display Utilities Help
USGS
File Name: C:\Program Files\Hec\HEC-DSSVue\sample.dss
Pathnames Shown: 17 Pathnames Selected: 6 Pathnames in File: 32 File Size: 90 KB
Search By Parts: A: B: C: D: E: F:
Number Part A Part B Part C Part D / range Part E Part F
8 GREEN RIVER OAKVILLE STAGE-OUT 01May1992 - 21May1992 1HOUR OBS
9 GREEN RIVER OAKVILLE STORAGE 01May1992 - 21May1992 1HOUR OBS
10 GREEN RIVER WALNUT FLOW-RES O... 22Apr1992 - 21May1992 1HOUR OBS
11 GREEN RIVER WALNUT PRECIP-INC 22Apr1992 - 12May1992 1HOUR OBS
12 GREEN RIVER WALNUT STORAGE 22Apr1992 - 21May1992 1HOUR OBS
13 MY BASIN DEER CREEK STAGE-FLOW USGS
/MY BASIN/RIVERSIDE/FLOW/01Mar1990 - 31May1990/1HOUR/OBS/
/MY BASIN/RIVERSIDE/PRECIP-INC/01Mar1990 - 31May1990/1HOUR/OBS/
USGS Download
File View Edit Help
Data Type: Daily Start Date: End Date:
Get USGS Station ID's ... California
Import Data
USGS Station ID's
Basin Name (A Part)
Location (B Part)
Other Qualifier (F Part)
11211790 COTTONWOOD C ELDERWOOD CA USGS
11250500 COTTONWOOD C FRIANT CA USGS
11375810 COTTONWOOD C OLINDA CA USGS
11376000 COTTONWOOD C COTTONWOOD CA USGS
11211785 COTTONWOOD C AB ... ELDERWOOD CA USGS
11375815 COTTONWOOD C AB SF COTTONWOOD CA USGS
11012000 COTTONWOOD C AB ... DULZURA CA USGS
10259600 COTTONWOOD WASH COTTONWOOD SPRINGS USGS
Import Select All Unselect All
/MY BASIN/RIVERSIDE/FLOW/01APR1990/1HOUR/OBS/
File Edit View
Precip (INCHES)
0.00
0.10
0.20
Flow (CFS)
70000
60000
50000
40000
30000
20000
10000
0
Flood Stage
Peak of 63,000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Apr1990
RIVERSIDE OBS PRECIP-INC
RIVERSIDE OBS FLOW

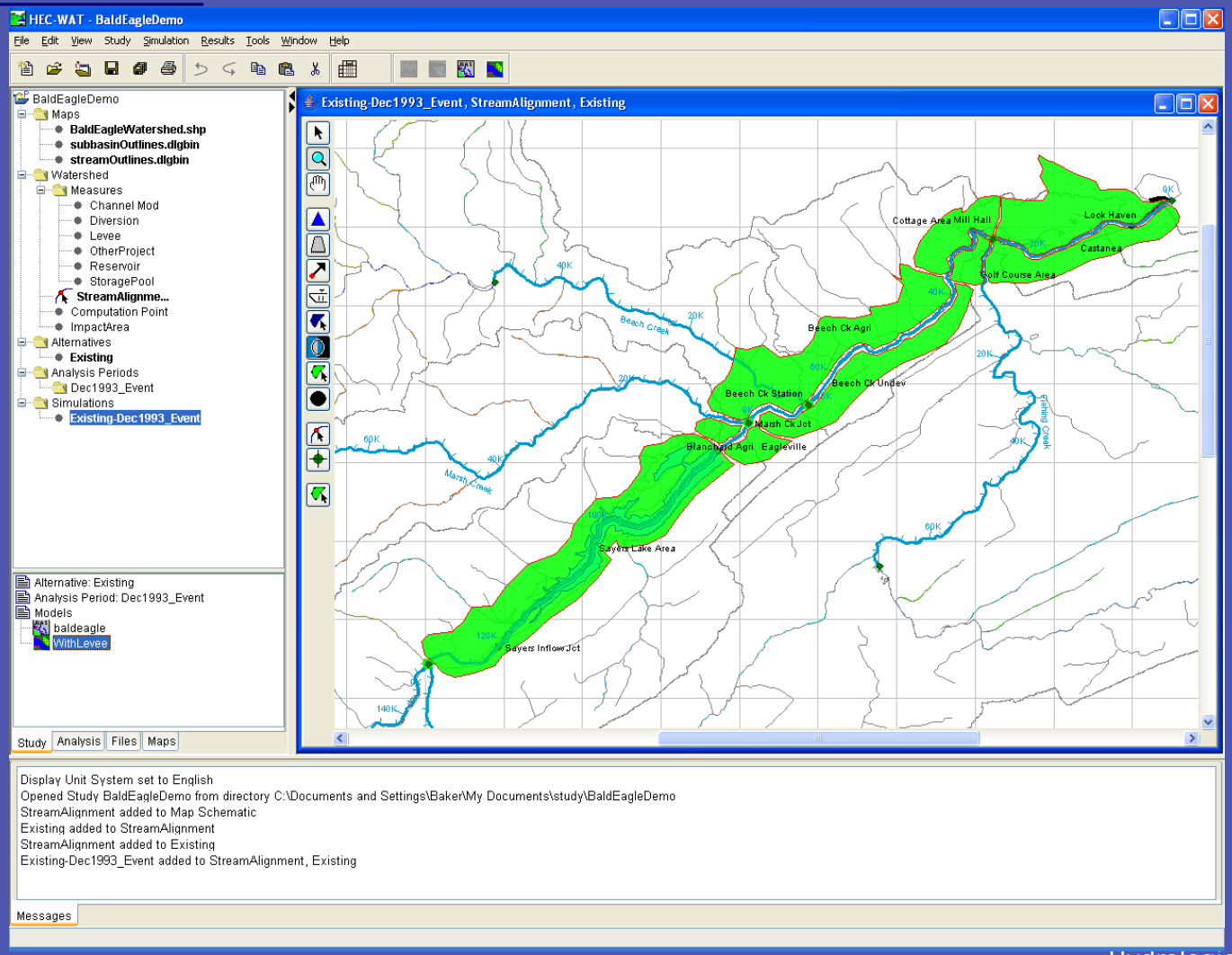
Statistical Analysis with HEC-SSP

- Frequency Analysis
- Durational Analysis
- Regression Analysis





Watershed Analysis Output



Simulations - Output Reports and Graphs

- Flow frequency curves
- Statistical plots
- Flow/stage hydrographs
- Inflow, storage, stage, outflow from reservoirs
- Cross-section plots
- Flood inundation boundary maps/water surface profiles
- Plan comparisons
- Expected Annual Damage (EAD) with risk
- Cost (National Economic Development (NED) plan)
- Environmental displays (National Ecosystem Restoration (NER))

Conclusion and Status

- The WAT is a program that integrates models and provides coordination and analysis for water resource studies.
- Integrates major HEC programs, such as HMS, RAS, ResSim, etc.
- Visualization tools to compare alternatives
- Currently completing beta version
  - Peer review of Alpha version Spring ’06
  - Documentation Fall ’06
  - Beta release and distribution Fall ‘06